

COMPETITION AND MARKET STRUCTURE IN THE HAWAII FISH INDUSTRY

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In the last decade considerable doubt has been cast on whether the Hawaii fish industry operates in a competitive manner. The industry has been characterized as being dominated by a handful of fishermen and fish dealers. As a result many people in private business and government feel that a few established firms prevent Hawaii's fish industry from expanding. It is argued that only established fishermen can get a fair price; others are eventually forced out of business; and, wholesalers keep prices to fishermen low and exploit retailers and consumers with high prices. A report by the U.S. Department of Commerce (1971) describes fresh fish wholesalers in Honolulu as cooperating to hold prices down. It further states that individual buyers engage in regular partnerships with advanced agreement to prevent the price of fish from going extremely high. Peterson (1973) reports that barriers to entry exist in the Hawaii fresh fish market created by procurement arrangements between established fishermen and fish dealers. The study also describes how wholesalers meet daily to discuss fish prices. Garrod and Chong (1978) conclude that there is little competition in the fresh fish market. They state that it is obvious that there are colluding tendencies among wholesalers who purchase fresh fish from fishermen. They further report that fishermen collude to determine the offer price. The Garrod and Chong study includes an assessment of the market structure of the fresh fish market in Honolulu. Based on telephone book listings, they identified 27 retailers and 17 wholesalers and described the attrition rate of established firms as low and the mortality high for new firms. They conclude from this and interviews that barriers to entry exist. Finally they conclude that, "The small number of firms...suggest that the phenomenon associated with a highly concentrated market could well exist in the fish wholesale sector. For example, the largest seven wholesalers employ 90% of the total number of employees in fish wholesaling. This may imply the presence of market leadership (price leadership and control of sources of supply) in the fish market. It seems natural for these firms to wield a great amount of market power. It may not even be surprising for them to seek to collude with other dealers."

The objective of this paper is to determine if market structure conditions exist in the Hawaii fish industry which would permit sellers or buyers to exercise market power and create market distortions. The paper is prompted by previous studies which conclude that sellers or buyers of fish in Hawaii collude. Other studies point out the importance of market structure studies for effective public policy (Buchanan, 1969; Lee, 1975; Smith, 1976). They show how policy measures differ with market structure when dealing with market distortions similar to those associated with common property rights in fisheries. A brief overview of the Hawaii fish industry is presented in the next section. The analysis of market structure begins with showing how much of a market is controlled by the largest sellers and buyers. Market structure is

further assessed with information on how freely new firms enter and exit the industry and how well firms are able to maintain their market shares over time.

The bounds of a market structure study are defined by the relevant geographical market and the relevant product line. For fresh fish in Hawaii, Oahu Island is chosen as the relevant geographical market. Only small amounts of fresh fish are imported from foreign countries or exported. The same is true for interstate shipments. Interisland shipments are small relative to the Oahu Island market. The product lines for such a study are usually based on how different products are substitutable in production and consumption. Perfect substitute products can be aggregated. Two types of fresh fish of major commercial importance in Hawaii fisheries are aku (skipjack tuna) and ahi (yellowfin and bigeye tunas). Two species are combined as ahi because there is little distinction made between them in the market. A third species group combines aku and ahi with albacore and kawakawa (bonito) to make up a product line referred to as all tunas. Bottom fish make up a fourth product line which is composed of the following species identified by their common Hawaiian name: uku, ulua, wekeula, gindai, hapuupuu, kahala, lehi, nohu, opakapaka, ehu, kalikali, and onaga. These species are considered close substitutes by consumers. Finally, all species of marine fish consumed fresh, including crustaceans, are combined to make up a fifth species group. This last product line assumes that consumers demand fresh seafood as a unique source of protein which has no perfect substitutes. It furthermore assumes that fishermen have the technology to easily move between fisheries as cost and price conditions change.

The data used in the study were collected from fishermen, wholesalers, and retailers. In some cases collection of the data was facilitated by cooperatives or fish agents who conducted sales or purchase for a number of fishermen and wholesalers. Records for individual transactions were collected and aggregated annually by selling and buying firm, and by species group. To determine how representative the recorded data are, the collected records were compared to independent reports made by fishermen to the State of Hawaii, Division of Fish and Game. Table 1 reconciles the difference between the fish sale reports of fishermen to the State and the recorded purchases collected for this study. Since fishermen do not report whether their catch is sold to the fresh fish market or to processors, I combine purchases of processors with the purchases for the fresh fish market. In 1977 the State Division of Fish and Game received fish landing reports for Oahu Island showing \$6,663,000 of sales. In addition, \$859,000 of wholesale fish sales on Oahu Island resulted from shipments from the surrounding Hawaiian Islands. Total sales on Oahu Island amounted to \$7,522,000. For the same year, the data collection efforts of the National Marine Fisheries Service (NMFS), Honolulu Laboratory revealed total purchases of \$7,491,000, which apparently missed about \$31,000 of transactions. More than 90% of the total purchases were made for the fresh fish market. Purchases made for canned fish will not be included in this study. For 3 of the 8 years, recorded purchases were greater than the reports to the State Division of Fish and Game. These years are reconciled with landings which were apparently not reported. However, among the possibilities, the difference could be the result of inaccurate counts of the total interisland shipments.

Table 1.--Annual reconciliation of fish sales and purchases for all species in the Oahu Island wholesale fresh fish and processed fish market, 1970-77.

(\$1,000)							
Year	Sales reported to State Division of Fish and Game	Shipments from outer islands	Not reported	Total	Purchases recorded by wholesalers, retailers, and processors	Not recorded	Total
1970	3,116	33	78	3,227	3,227	--	3,227
1971	4,080	30	--	4,110	4,029	81	4,110
1972	4,589	70	--	4,659	4,557	102	4,659
1973	4,796	99	--	4,895	4,681	214	4,895
1974	4,296	307	102	4,705	4,705	--	4,705
1975	4,063	626	56	4,745	4,745	--	4,745
1976	6,237	550	--	6,787	6,602	185	6,787
1977	6,663	859	--	7,522	7,491	31	7,522

Figure 1 shows the three major levels of transactions in the distribution of fish for the fresh fish market on Oahu Island. When wholesalers are vertically integrated to represent fishermen at the ex-vessel level and also to make retail sales, it creates a maze of interactions in the market. Fishermen contribute to the maze by bypassing wholesalers and retailers to sell directly to consumers. On the other hand, retailers may circumvent wholesalers by purchasing directly from the fishermen. In 1980 the NMFS Honolulu Laboratory interviewed 108 wholesalers to determine in part how fresh fish sales were distributed in Hawaii. The results show that about 14% of ex-vessel sales go to retailers. The remainder, fishermen either sell to wholesalers (50%) or are represented in the Oahu Island market by wholesalers (35%). About 98% of final purchases are made from retailers with only small amounts coming directly from wholesalers and fishermen. In all of this, two levels of wholesale transactions can be identified. It is the first level of wholesale transactions that is the interest of this study. Besides fishermen, sellers at the first level will include wholesalers in the Oahu Island market who represent hundreds of fishermen from the outer islands and some on Oahu Island. Buyers at the first level are made up of wholesalers and retailers.

The degree of specialization of sellers and buyers is described in Figure 2 for the year 1976. In 1976 there were a total of 315 sellers and 123 buyers of fresh fish at the first wholesale level. Of the sellers, 67% dealt in tuna and 32% in bottom fish. About 16% specialized exclusively in tuna. Less specialized, 18% sold tuna, bottom fish, and other species. Associated with each group of sellers is a share of total sales. The 20% of sellers who specialized in fish other than tunas and bottom fish accounted for only 1% of total sales. On the buyers side we see that 32% of the firms, those specializing in tuna, only accounted for 2% of total purchases. In contrast, 90% of all purchases were made by 29% of the buyers who dealt in all three species group. In the following section we will assess how sales and purchases are concentrated by small groups of sellers and buyers at the first level of wholesale transactions.

Between the economists' theoretical models of pure competition (many firms acting independently of each other) and pure monopoly (a single firm exploiting its market power) exists a wide range of oligopoly and oligopsony models. I promise not to use these words again. The latter two models refer to a relatively small number of sellers or buyers who act in concert, tacitly or explicitly, to maximize their joint profits. The many economic theories which explain the behavior of a small group of firms differ greatly, but the models have in common the assumption that a small group of sellers or buyers control a large portion of sales or purchases. When sales or purchases are concentrated in such a manner, the group of firms can influence the price of the product. There are many ways of measuring market power (Scherer, 1970). Here we use the most commonly used measure, the percentage of total industry sales (or purchases) for the largest four and eight sellers (or buyers). This measure is usually called the concentration ratio. When the concentration ratio is relatively small, it is unlikely a group of sellers or buyers can influence prices. Either a small group of the largest firms control an insufficient quantity to influence prices, or a larger group that does control a large quantity cannot agree because of the many members. On the other hand, when the

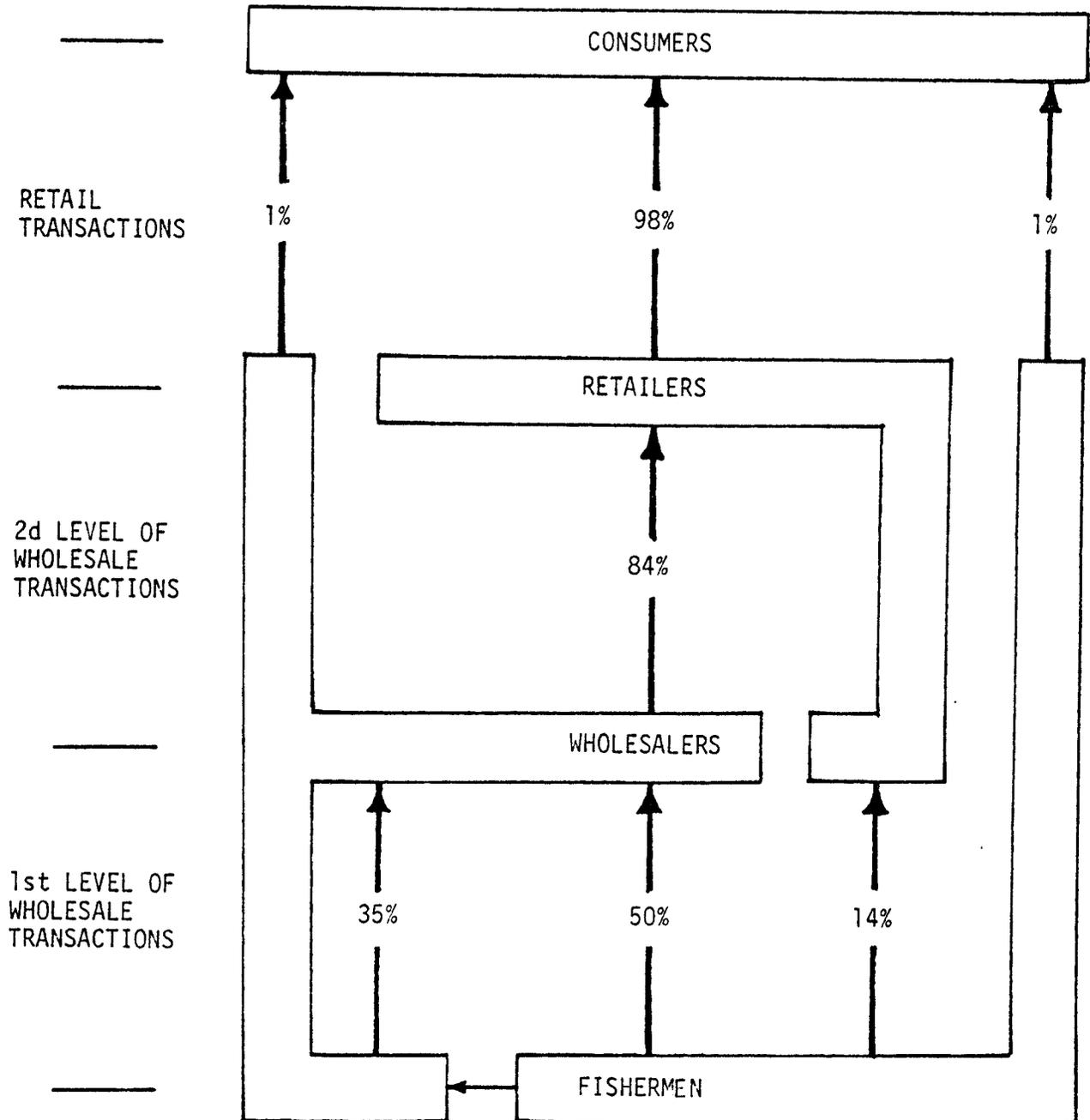


Figure 1.--Distribution of sales at two levels of wholesale transactions and one level of retail transactions in the Oahu Island fresh fish market for all species, 1975-80.

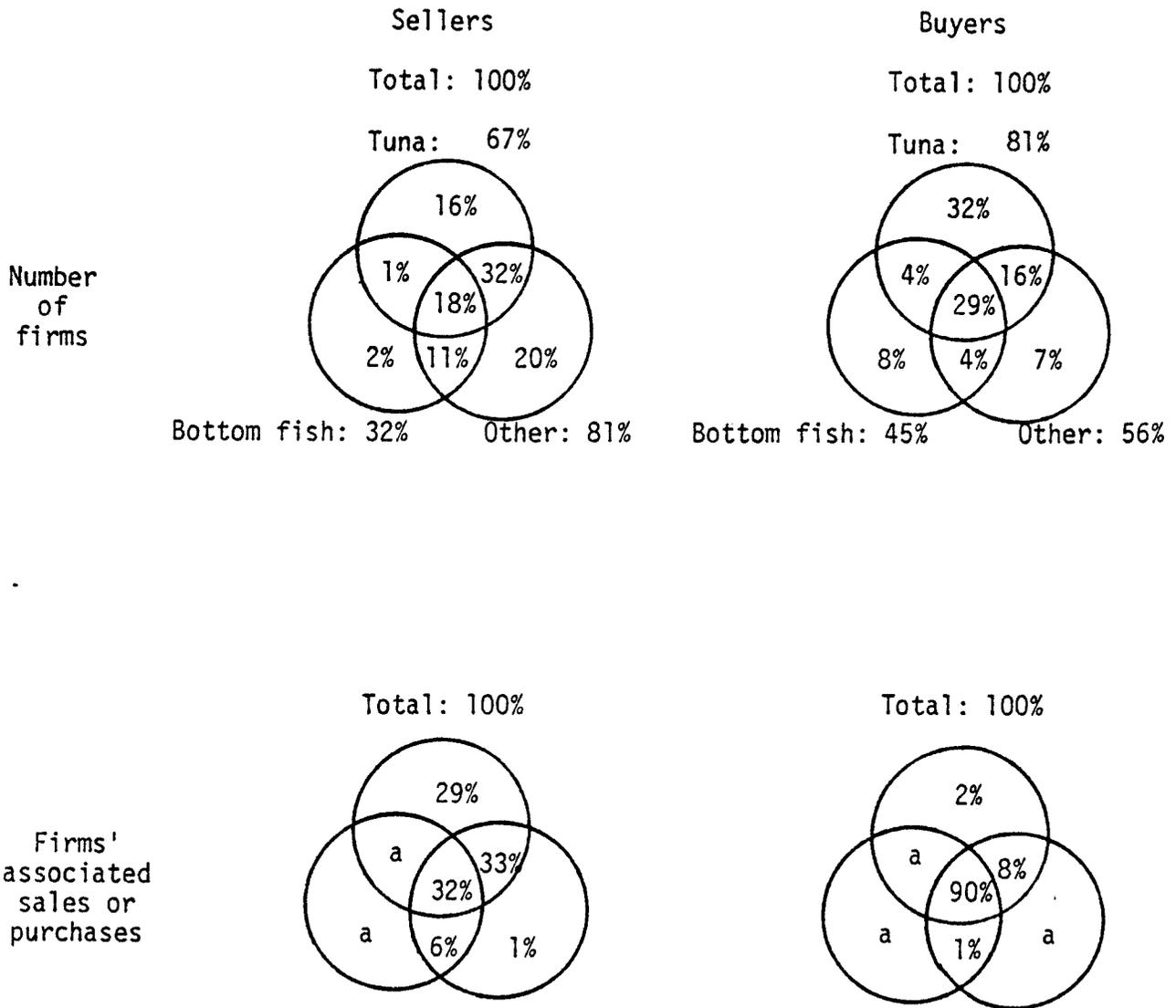


Figure 2.--Distribution of firms and associated sales and purchases, respectively, for sellers and buyers by selected species groups in the Oahu Island wholesale fresh fish market during 1976.

^aLess than 0.5%.

concentration ratio is relatively high, it is possible the largest firms are able to cooperate, adjusting quantity to stabilize prices over time; at a higher price level by sellers or at a lower price level by buyers.

Thus, when the concentration ratio is high, profit rates may rise above the competitive level at the cost of an exploited group with a resulting net loss to society. There is some dispute over the relationship between profit rates and the degree of seller concentration. Three early studies conclude that a concentration ratio above 70% for the four-largest firms will result in higher profit rates (Bain, 1951; Stigler, 1964; Mann, 1966). A recent study concludes that the concentration ratio for the four-largest firms need only be 55%, and 70% for the eight-largest firms, to find higher profit rates (Meehan and Duchesneau, 1973). The controversy continues in economics and has been expanded by some to conclude that there exists no relationship between the concentration ratio and profit rates (Brozen, 1970).

Applying the first criteria of 70% for the four-largest firms to Table 2 we see the concentration ratios for buyers in 1977 fall below the critical level for each species group. On the sellers side only the concentration ratio for aku sellers exceeds the 70% criteria during 1977. It has been demonstrated how aku sellers may use this apparent market power (Hudgins, 1980). However, actual market power may not exist if close substitute products are available. When aku is aggregated with other tuna species the seller concentration ratio falls markedly--from 99% to 56%. As discussed earlier, it is appropriate to aggregate in this manner when defining the relevant product line if in the fresh fish market other tuna species serve as ready substitutes. Following a second criteria of 55% for the four-largest firms and 70% for the eight-largest, from Tables 2 and 3, 4 of the 10 cases for sellers exceed the critical value. On the buyers side only the four-largest firms for all tunas and all species fall below the critical concentration ratio as well as all species for the eight-largest buyers. Over the 8-year period there is no obvious trend in concentration ratios. With the exception of aku sellers, then, the concentration ratios are not excessively high. However, concentration is not sufficiently low to conclude that sellers and buyers are not able to exercise market power and create market distortions. Therefore information on the underlying behavior of the firms is necessary to further assess market structure.

Concentration ratios above the critical levels will not imply higher profit rates if existing firms know that new firms can easily enter the market. Thus, we now continue with the assessment of structure by analyzing the entry and exit activities for all sellers and buyers of three species groups: all tunas, bottom fish, and all species. These activities are described in Tables 4-9. The tables show the total number of new firms that enter each year, the number of firms leaving the market for a particular species group, the number of firms which enter and exit during the same year, and the resulting total number of firms which participate in the market during the year. For example, from Table 4, during 1970 there were a total of 124 firms selling tuna. By the end of the year, 52 of the firms stopped dealing in tuna or went out of business. In 1971, 54 new firms entered for a new firm total of 126. Of the 54 new firms, 40 left the market by the end of 1971. Another 17 exited the

Table 2.--Annual concentration of sales and purchases, respectively, for the four-largest sellers and buyers of selected species and species groups in the Oahu Island wholesale fresh fish market, 1970-77.

(Percent)										
Year	Four-largest sellers					Four-largest buyers				
	Ahi	Aku	All tunas	Bottom fish	All species	Ahi	Aku	All tunas	Bottom fish	All species
1970	34	99	57	66	41	78	62	52	52	48
1971	41	99	63	66	47	78	60	51	52	46
1972	59	99	65	65	48	76	59	51	61	46
1973	31	99	65	59	48	76	56	51	52	45
1974	48	99	68	49	54	64	57	48	57	46
1975	50	99	66	48	49	81	57	51	50	48
1976	39	99	60	45	47	63	59	49	60	45
1977	40	99	56	47	45	57	56	47	63	44

Table 3.--Annual concentration of sales and purchases, respectively, for the eight-largest sellers and buyers of selected species and species groups in the Oahu Island wholesale fresh fish market, 1970-77.

(Percent)										
Year	Eight-largest sellers					Eight-largest buyers				
	Ahi	Aku	All tunas	Bottom fish	All species	Ahi	Aku	All tunas	Bottom fish	All species
1970	58	99	71	81	54	95	81	76	78	70
1971	61	99	77	83	58	97	81	75	77	68
1972	65	99	79	86	59	97	80	74	83	65
1973	57	99	76	76	57	93	80	73	74	65
1974	69	99	81	65	66	86	83	73	78	70
1975	71	99	81	67	62	88	84	76	75	70
1976	58	99	74	69	59	82	85	73	82	66
1977	58	99	72	68	58	77	81	71	83	67

Table 4.--Annual entry and exit activity by sellers in the Oahu Island wholesale fresh fish market for all tunas, 1970-77.

Year	(a) Enter	(b) Exit	(c) Same year enter-exit	(d) Active firms	(a+b-c)/d Turnover rate
	(Number of firms)				(%)
1970	--	52	--	124	--
1971	54	57	40	126	56
1972	51	50	37	120	53
1973	58	58	42	128	58
1974	56	56	38	126	59
1975	60	44	30	130	57
1976	124	93	70	210	70
1977	165	--	--	282	--

Table 5.--Annual entry and exit activity by buyers in the Oahu Island wholesale fresh fish market for all tunas, 1970-77.

Year	(a) Enter	(b) Exit	(c) Same year enter-exit	(d) Active firms	(a+b-c)/d Turnover rate
	(Number of firms)				(%)
1970	--	37	--	85	--
1971	14	13	3	62	39
1972	23	24	15	72	44
1973	39	29	23	87	52
1974	25	21	14	83	39
1975	30	31	22	92	42
1976	38	40	29	99	49
1977	34	--	--	93	--

Table 6.--Annual entry and exit activity by sellers in the Oahu Island wholesale fresh fish market for bottom fish, 1970-77.

Year	(a) Enter	(b) Exit	(c) Same year enter-exit	(d) Active firms	(a+b-c)/d Turnover rate
	(Number of firms)				(%)
1970	--	27	--	58	--
1971	29	28	19	60	63
1972	25	23	13	57	61
1973	46	40	30	80	70
1974	38	35	25	78	62
1975	50	43	29	93	69
1976	49	45	33	99	62
1977	95	--	--	149	--

Table 7.--Annual entry and exit activity by buyers in the Oahu Island wholesale fresh fish market for bottom fish, 1970-77.

Year	(a) Enter	(b) Exit	(c) Same year enter-exit	(d) Active firms	(a+b-c)/d Turnover rate
	(Number of firms)				(%)
1970	--	23	--	56	--
1971	14	16	11	47	40
1972	7	8	4	38	29
1973	19	14	11	49	45
1974	16	14	10	51	39
1975	13	11	6	50	36
1976	17	20	14	56	41
1977	14	--	--	50	--

Table 8.--Annual entry and exit activity by sellers in the Oahu Island wholesale fresh fish market for all species, 1970-77.

Year	(a) Enter	(b) Exit	(c) Same year enter-exit	(d) Active firms	(a+b-c)/d Turnover rate
	(Number of firms)				(%)
1970	--	135	--	270	--
1971	77	99	57	212	56
1972	95	81	58	208	57
1973	100	96	66	227	57
1974	85	84	54	216	53
1975	120	102	71	252	60
1976	165	125	94	315	62
1977	245	--	--	435	--

Table 9.--Annual entry and exit activity by buyers in the Oahu Island wholesale fresh fish market for all species, 1970-77.

Year	(a) Enter	(b) Exit	(c) Same year enter-exit	(d) Active firms	(a+b-c)/d Turnover rate
	(Number of firms)				(%)
1970	--	54	--	144	--
1971	28	32	17	118	36
1972	25	40	20	111	41
1973	42	38	28	113	46
1974	36	35	23	111	43
1975	44	45	32	120	48
1976	48	47	35	123	49
1977	38	--	--	114	--

same year. This activity can be described by what I call a turnover rate--the number of new entering firms and exiting firms relative to the total firms in the market. Compensation is made for the double counting of firms which may enter and exit during the same year. We see that under the static concentration ratios is a bustle of activity. In 1976, the turnover rate for tuna sellers was a remarkable 70%. Even if we ignore the firms which enter and exit during the same year, the turnover rate is 55%--39% are new firms (not present in the previous year) and 16%, established firms in the market, exited (making no sales the following year). Tables 8 and 9 cover sellers and buyers of all species. These turnover rates are not markedly lower than for all tunas and bottom fish, which would have suggested that some of the activity could be explained by firms moving about between fisheries. The turnover rate for sellers is always higher than that for buyers. In Table 9 the turnover rate for buyers operating in the wholesale fresh fish market for all species ranged from 36% to 49%. Ignoring the firms which enter and exit the same year, the turnover rate is still greater than 25% for each of the 6 years. All of this entry and exit activity suggests that there are no serious impediments which may prevent the free flow of resources in and out of the markets. When firms see greater opportunities for profits in a fresh fish market, they act without restraint. Larger firms are not protected by what is sometimes referred to as barriers to entry. If larger buyers attempt to restrict their purchases, reducing the price of fish, new buyers move in to bid up the price toward the competitive level. If large sellers cooperated to restrict production, causing prices to increase, new sellers enter with an increase in supply, moving prices back down toward the competitive level. As we will see in the following section, most of the larger sellers and buyers are unsuccessful in maintaining their market position in the face of this bustling market activity.

If we are to further understand the significance of the concentration ratios presented in Tables 2 and 3 we need to understand how the largest sellers and buyers compete for their market positions. Relatively high concentration ratios give firms the opportunity to collude and exercise their market power. But if they are constantly threatened by smaller firms moving up into the ranks of the larger sellers and buyers, it is not likely the larger firms will provide incentives of higher prices to sellers or lower prices to buyers. In addition larger firms which do not maintain their efficiency will be forced down the ranks by more productive expanding firms. Figures 3-11 illustrate the ranking and time track of the eight-largest sellers and buyers for the five selected species groups. The largest firms for each species group are labeled A through H according to their ranking from largest sales or purchases in value. When firms exit the market or otherwise move below the eight-largest firms, their time track terminates or falls below the eighth largest firm. For example, firms E and G in Figure 3 do not get underway since they exit the first year. By 1977 only one of the original firms, B, maintained its market position, but only after pressure by new firms entering the eight-largest sellers of ahi. As discussed earlier, there is not as much entry-exit activity among buyers, but it is important to recognize how much market positions shift over time. Shifting market positions are not captured by the turnover rate, but play an equally important role in explaining the significance of concentration ratios. In four of the five markets a large seller ranks at the top each year, although it is not the same firm in each

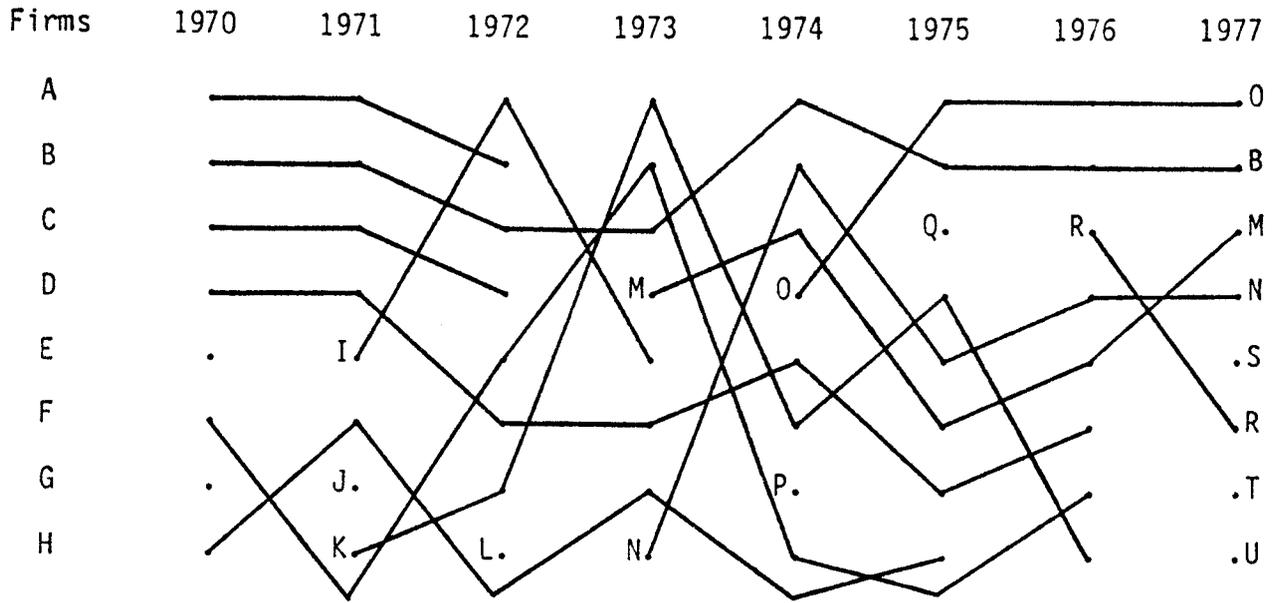


Figure 3.--Annual ranking and time track of the eight-largest sellers of ahi in the Oahu Island wholesale fresh fish market, 1970-77.

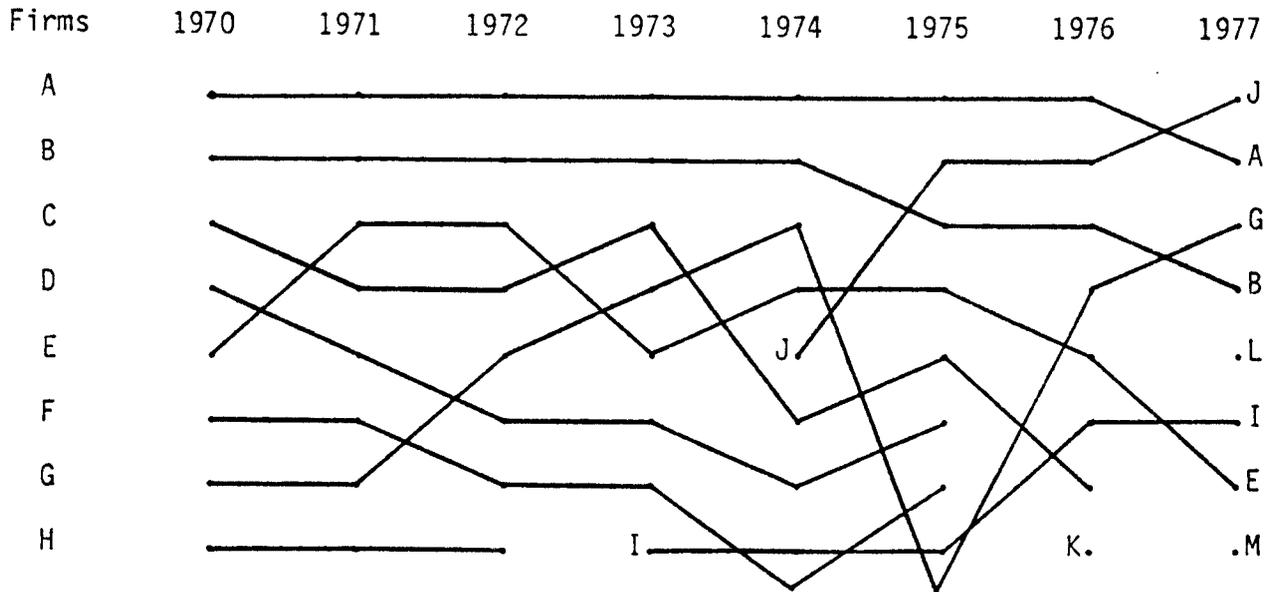


Figure 4.--Annual ranking and time track of the eight-largest buyers of ahi in the Oahu Island wholesale fresh fish market, 1970-77.

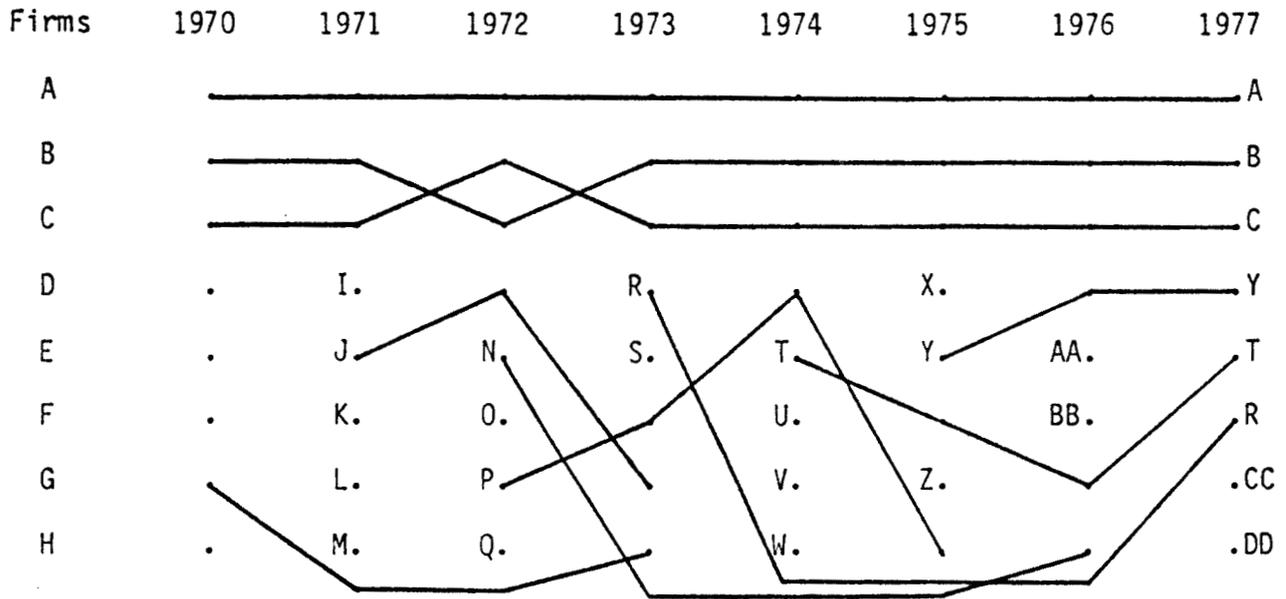


Figure 5.--Annual ranking and time track of the eight-largest sellers of aku in the Oahu Island wholesale fresh fish market, 1970-77.

(Insufficient disaggregated data exists by buyers to complete ranking and time track for aku buyers over the 8-year time period.)

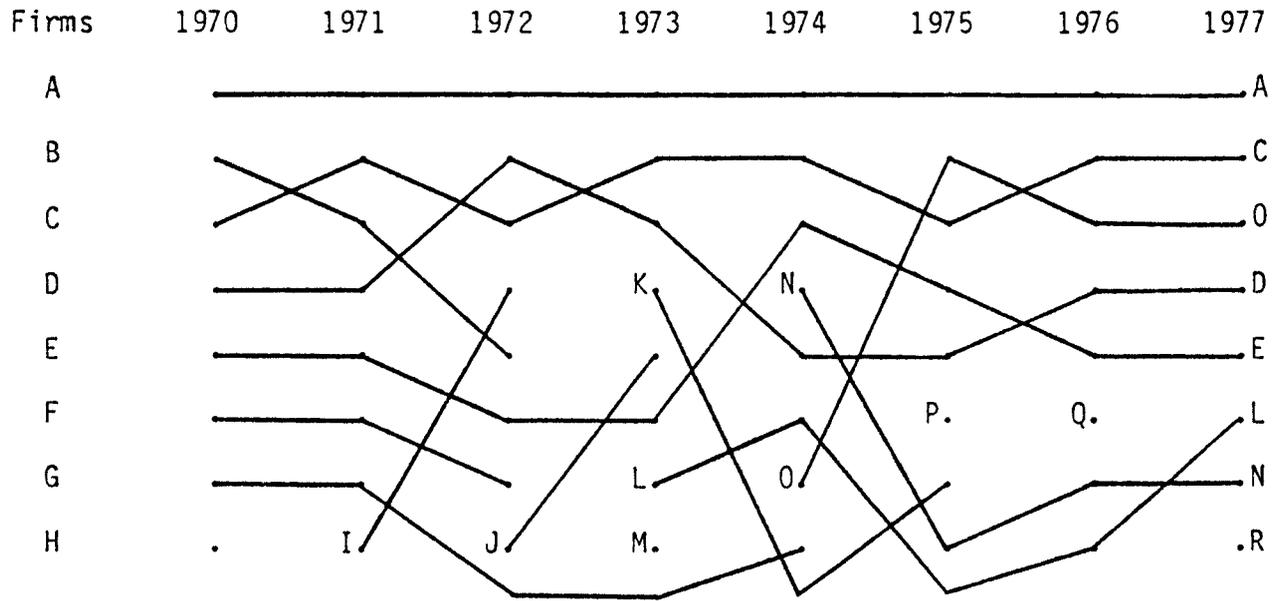


Figure 6.--Annual ranking and time track of the eight-largest sellers of all tunas in the Oahu Island wholesale fresh fish market, 1970-77.

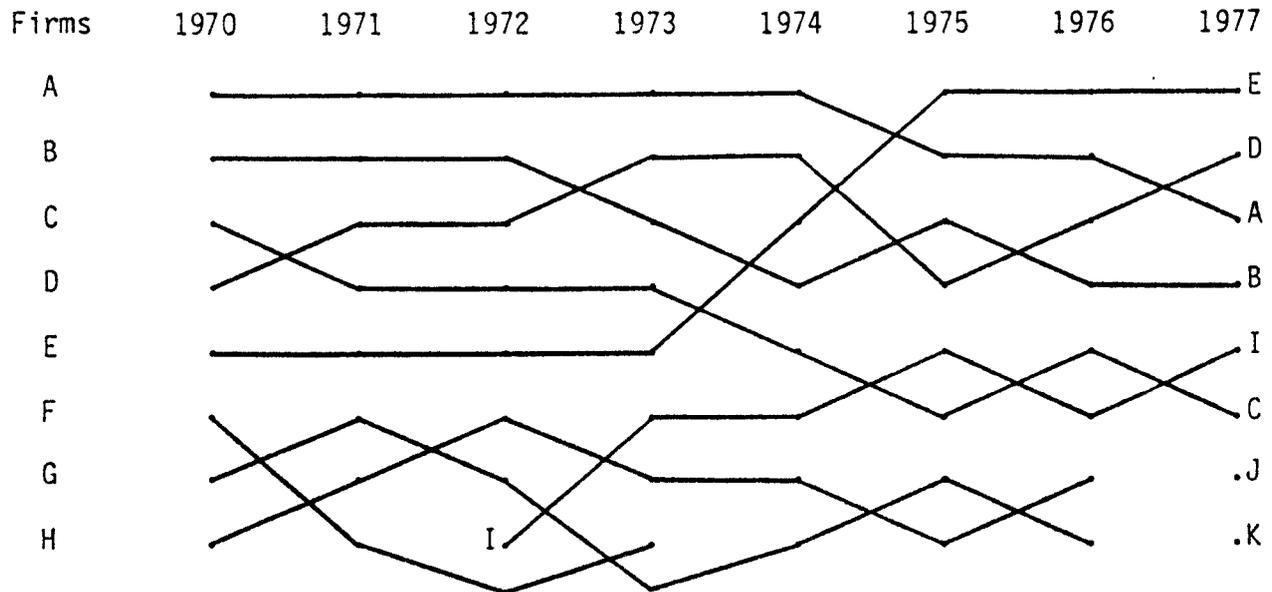


Figure 7.--Annual ranking and time track of the eight-largest buyers of all tunas in the Oahu Island wholesale fresh fish market, 1970-77.

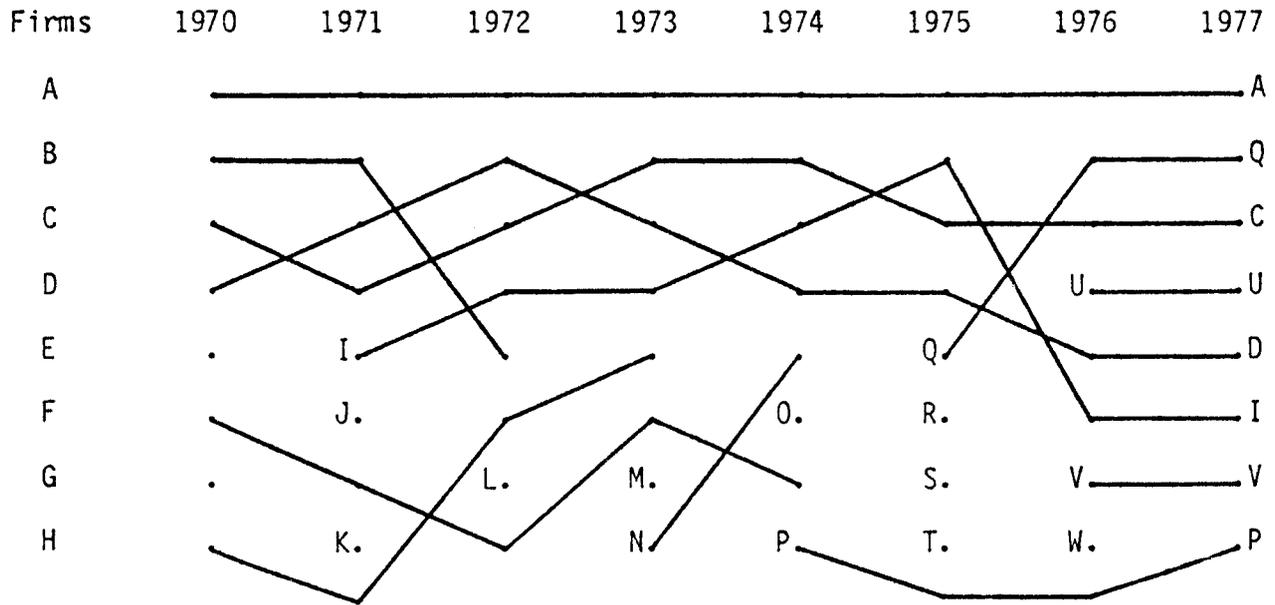


Figure 8.--Annual ranking and time track of the eight-largest sellers of bottom fish in the Oahu Island wholesale fresh fish market, 1970-77.

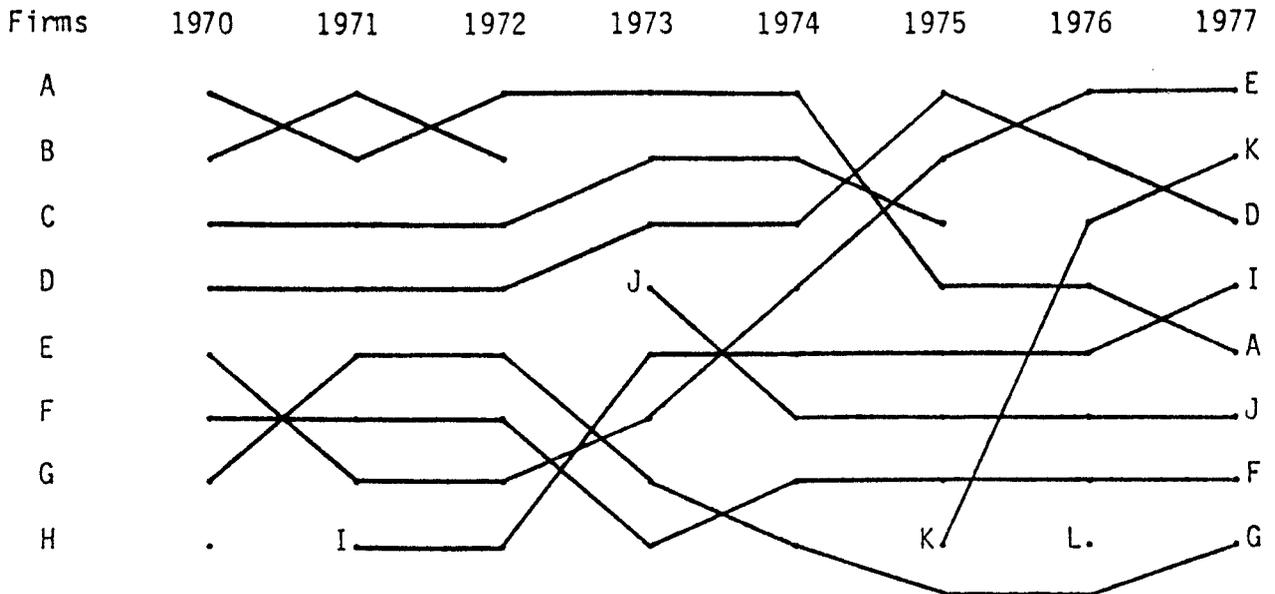


Figure 9.--Annual ranking and time track of the eight-largest buyers of bottom fish in the Oahu Island wholesale fresh fish market, 1970-77.

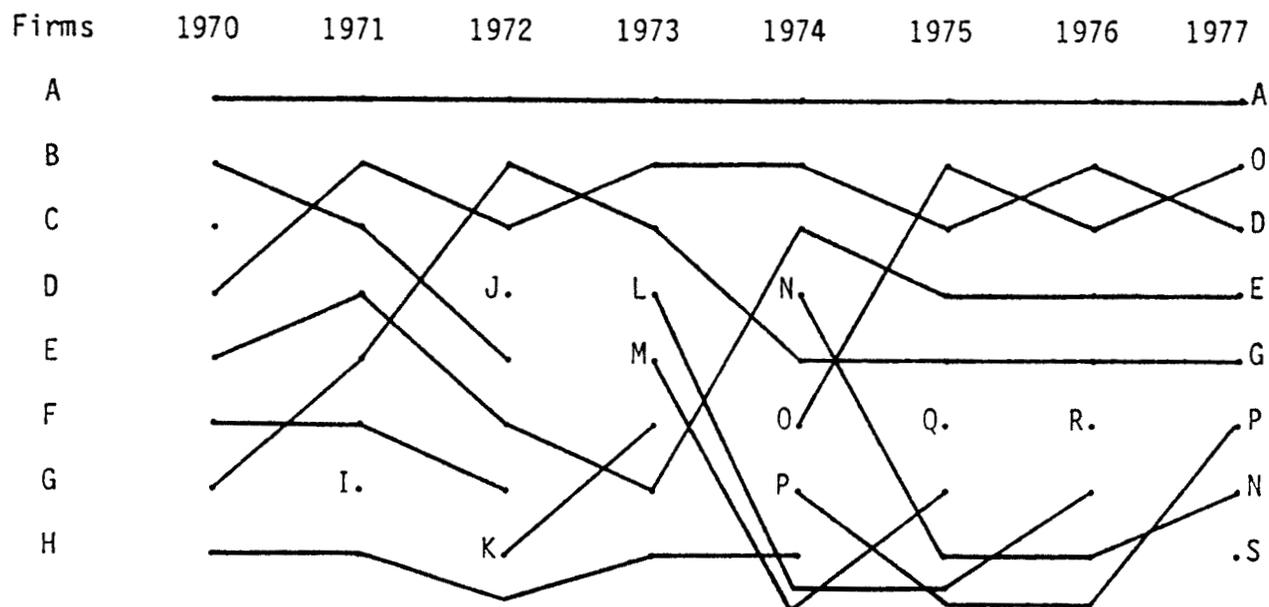


Figure 10.--Annual ranking and time track of the eight-largest sellers of all species in the Oahu Island wholesale fresh fish market, 1970-77.

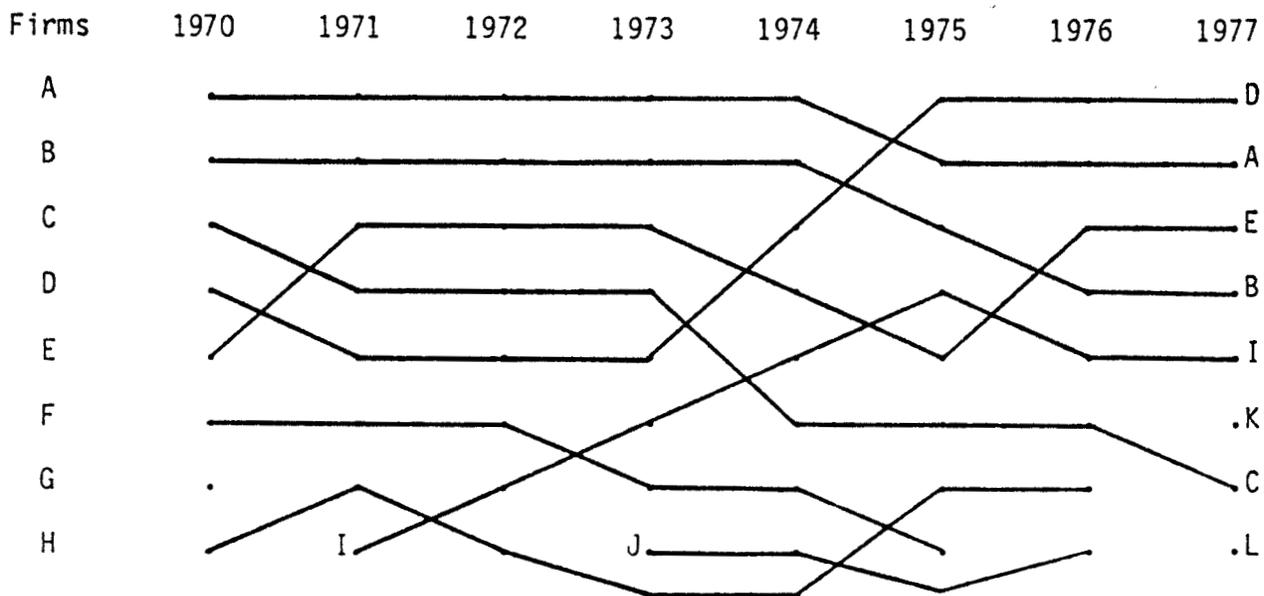


Figure 11.--Annual ranking and time track of the eight-largest buyers of all species in the Oahu Island wholesale fresh fish market, 1970-77.

market. In the aku fishery, Figure 5, the top three firms are not forced out by other firms. For the most part, though, sellers' market positions are extremely volatile. In Figure 10 for all species, only four of the original eight survived the 8 years. Some of the changes in rank or exits from the market are attributed to natural attrition--a vessel sinks or a seller retires. Some of the buyers show interesting trends. In Figure 9 for bottom fish, firm E gets a slow start but demonstrates that it possessed some clear advantage over other firms. The growth of the firm seems to push the four-largest buyers either out of the top eight or reduce their shares. Although there is clearly less entry-exit activity among the buyers compared to the sellers, the shifting of market positions among buyers is extreme. An exception is buyer A of ahi, Figure 4, but firm J enters in 1974 and eventually gains the top position by 1977.

When we tried to identify a trend in concentration ratios over time earlier it was not apparent that the largest concentration of sales and purchases fell into the hands of different firms each year. This is hardly conducive to the exercise of market power. Therefore, it is becoming a more frequent practice in industrial organization studies to assess how the concentration ratio for a given set of firms changes over time. In Tables 10 and 11 concentration ratios are given for the four- and eight-largest sellers and buyers of 1970 over the 8-year period under study. The measures for 1970 are identical to those in Tables 2 and 3. But as time passes the market shares of the largest firms in 1970 are eroded as other firms expand. Aku sellers maintain their market share but as discussed earlier, aku may not be the relevant product line in defining the market if other tunas are good substitutes.

The market structure conditions do not exist in the Hawaii fish industry which would permit sellers or buyers to exercise market power and create market distortions. This conclusion is based on the presence of a large number of sellers and buyers who operate in the industry, the share of the market for the largest sellers and buyers, entry conditions, and how the largest firms maintain their market shares over time. Concentration ratios for sellers and buyers in most of the species groups are not excessively high compared to other industries. However, the market shares of the largest firms are not sufficiently low to conclude that sellers and buyers are not able to exercise market power. Annual entry and exit activity is very high, though, even when discounting for firms which entered and exited the market the same year. Finally, firms do not maintain their market shares in the markets for different aggregated species over the 8-year period.

ACKNOWLEDGMENT

The computer programming for this paper was performed by James C. Cooper.

Table 10.--Annual concentration of sales and purchases, respectively, for the four-largest sellers and buyers in 1970 of selected species and species groups in the Oahu Island wholesale fresh fish market, 1970-77.

(Percent)										
Year	Four-largest sellers in 1970					Four-largest buyers in 1970				
	Ahi	Aku	All tunas	Bottom fish	All species	Ahi	Aku	All tunas	Bottom fish	All species
1970	34	99	57	66	41	78	62	52	52	48
1971	40	99	63	66	45	74	60	51	53	45
1972	35	99	65	65	45	72	59	51	62	44
1973	21	99	64	52	42	75	56	51	46	43
1974	27	99	59	39	43	61	56	46	46	44
1975	21	99	54	38	37	51	53	42	40	45
1976	17	99	54	33	36	43	57	40	30	42
1977	14	99	49	32	32	27	51	36	24	40

Table 11.--Annual concentration of sales and purchases, respectively, for the eight-largest sellers and buyers in 1970 of selected species and species groups in the Oahu Island wholesale fresh fish market, 1970-77.

(Percent)										
Year	Eight-largest sellers in 1970					Eight-largest buyers in 1970				
	Ahi	Aku	All tunas	Bottom fish	All species	Ahi	Aku	All tunas	Bottom fish	All species
1970	58	99	71	81	54	95	81	76	78	70
1971	59	99	76	75	58	97	81	75	75	67
1972	56	99	76	71	58	97	80	73	80	66
1973	46	99	71	61	51	92	80	71	64	62
1974	43	99	71	45	56	79	83	68	66	64
1975	36	99	65	43	52	66	84	70	63	63
1976	29	99	61	35	46	61	85	67	58	59
1977	23	99	56	36	43	41	80	62	59	56

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